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## ***Studies of Relationships Among Outer Solar System Small Bodies and Related Objects***

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### ***Strategy***

This program involves telescopic observations of colorimetry, spectroscopy and photometry of small bodies of the solar system, emphasizing possible relationships among outer solar system asteroids, comets, and certain satellites. Earth approacher targets of opportunity and lab spectroscopic studies are included.

### ***Progress and Accomplishments***

The current year of the program is very productive. Our discovery that a band at 2.2  $\mu\text{m}$  can be associated with  $\text{C}\equiv\text{N}$  bearing solid organic material in asteroids, comets, the Uranian rings, and Iapetus, has been announced in 1991 LPSC and 1990 DPS abstracts. We completed an MKO UH-88 run in March 1990, netting lightcurve data on 7 Trojan and Hilda asteroids. We also completed an IRTF observing run in December 1990 with astrometry on Galileo target asteroid 951 Gaspra, and new bolometry and/or colorimetry on other asteroids and comets. We completed a new paper on our discovery that 3 Earth-approaching asteroids show spectra matching basaltic achondrites and this was published in *Icarus* in 1991. Three other papers were published in *Icarus* in calendar 1990. Also, I am serving on the NASA Discovery Program Science Working Group on low-cost missions to small bodies, at the invitation of Wes Huntress and Joe Veverka.

### ***Projected Accomplishments***

We have several papers in progress. We have submitted a paper on the first identification of solid  $\text{C}\equiv\text{N}$  bearing organic materials on outer solar system bodies. We are preparing a laboratory study of spectra of organic asteroid-candidate materials and another paper on Trojan lightcurves. We anticipate at least one Mauna Kea observing run in 1991 to study outer solar system bodies, especially 2061 Chiron.

### ***Publications***

Cruikshank, Tholen, Hartmann, Bell, and Brown (1991). Three Earth-Approaching Asteroids and the Source of the Basaltic Meteorites, *Icarus*, **89**, 1-13.

Hartmann and Tholen (1990). Comet Nuclei and Trojan Asteroids: A New Link and a Possible Mechanism for Comet Splittings, *Icarus*, **86**, 448-454.

Hartmann, Tholen, Meech, and Cruikshank (1990). 2060 Chiron: Colorimetry and Cometary Behavior, *Icarus*, **83**, 1-15.

Hartmann (1990). Additional Evidence About an Early Intense Flux of C Asteroids and the Origin of Phobos, *Icarus*, **87**, 236-240.